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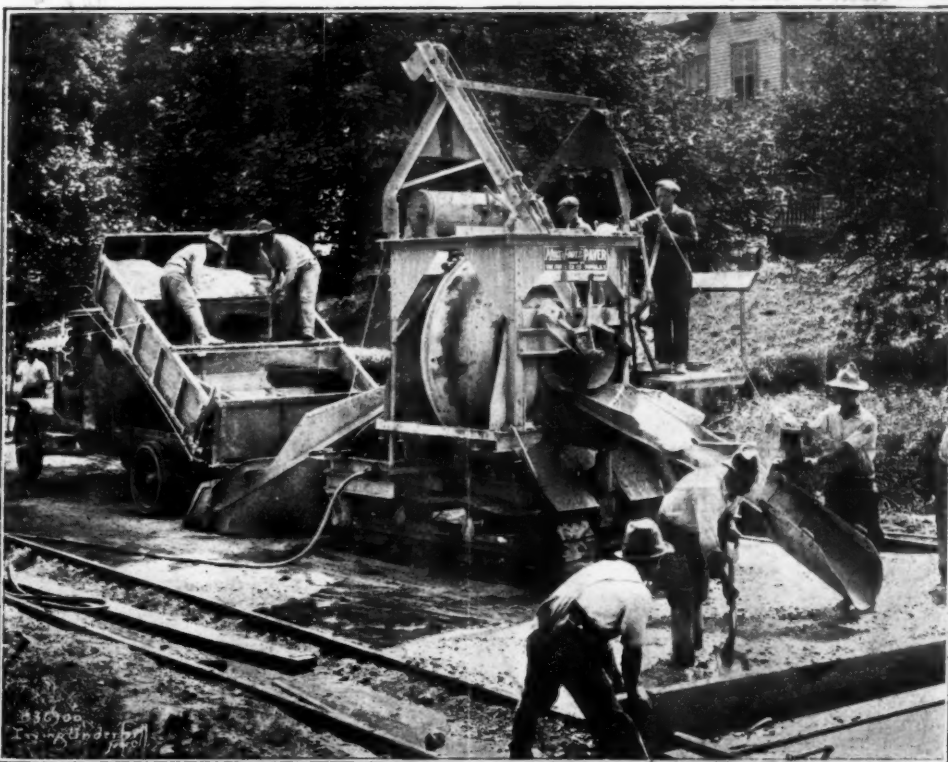
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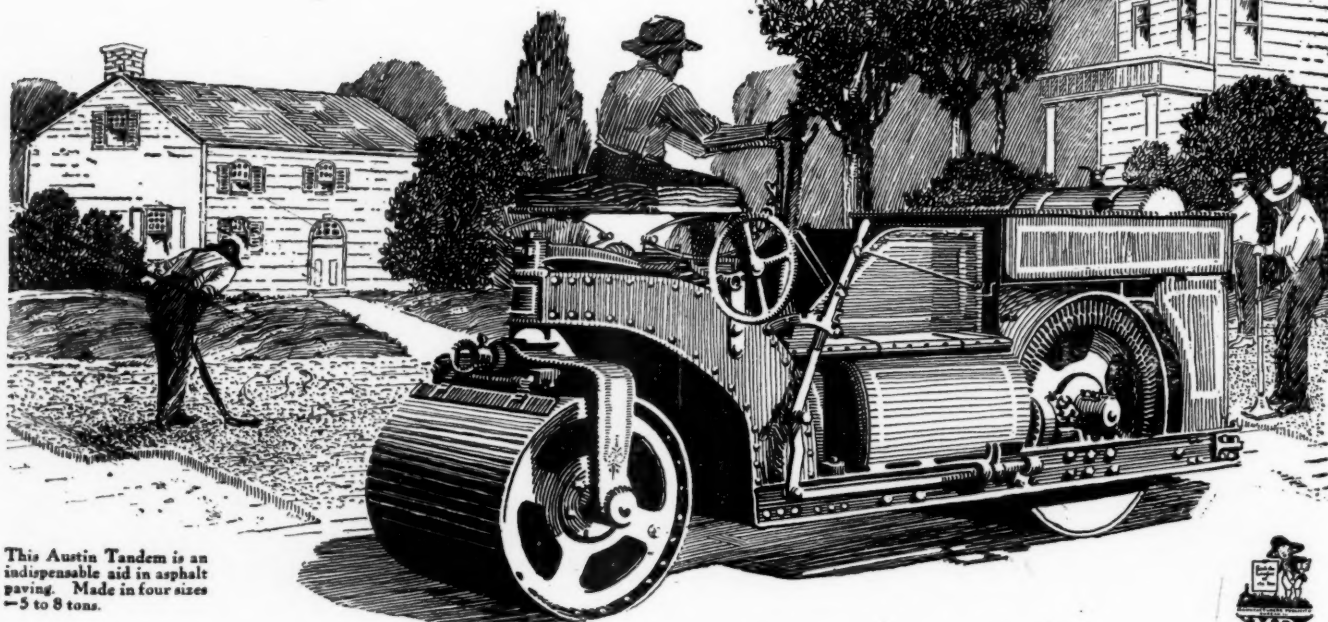
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Vol. 49

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No. 17

Gravel Roads: Construction and Surface Treatment^{*}

By PHILIP P. SHARPLES†

In Maine about 88 per cent of the improved roads are gravel and practically all in Vermont, Indiana and many other states. Among states known for their high-class highway improvements, Massachusetts has about 65 per cent of its improved roads gravel, Ohio 55 per cent and the state of Washington 50 per cent. Of all of the projects which have been granted Federal aid during the past three years, more than one-quarter have been gravel roads. It is therefore important that the methods employed in constructing and maintaining gravel roads be of the highest order. And yet the subject has received little discussion as compared to other forms of improved highways. We give in this issue the views of three highway experts on the subject of gravel roads. The first, by an official of the Barrett Company, tells how to construct gravel roads and apply bituminous materials to them as a surface treatment. Another deals with specifications for such roads, and the third discusses the use of them in arid countries.

The importance of the gravel road problem is realized when the figures for Federal Aid projects are analyzed. For the years 1917, 1918, 1919, 27.67 per cent of the projects called for gravel roads. It was only exceeded by the mileage of earth roads.

Wherever good road-building gravels are available, the gravel road is the logical step between an earth road and a macadam type of road. Its usefulness depends on the gravels available, the method of using them, the care taken in providing drainage, climatic conditions, traffic, and above all, maintenance.

During the last few years attempts have been made to utilize the bituminous materials used so successfully in macadam road maintenance in surface-treating gravel roads. Naturally much of the success of these treatments has depended on the gravel roads chosen for the experiment. As in the early days of macadam treatment, the attempt has been made to save gravel roads which had so far disintegrated that a surface treatment could be of little use, or to treat roads which were gravel only in name and not in fact.

Needless to say, a surface treatment cannot supply drainage, a foundation, or modify a poor

construction. Its only office is to protect, by a surface skin, the structure that lies beneath. If the skin cannot be supported, the road cannot be maintained by surface treatments.

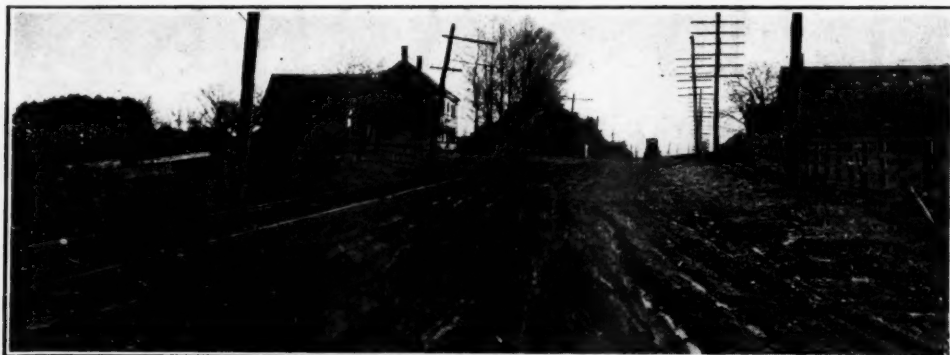
Except in certain localities like New England and part of Texas, and scattered points in other states where a fund of practical experience has been accumulated, the bituminous treatment of gravel roads may be said to be in the experimental stage.

The importance of surface treatments is everywhere realized. A gravel road, well built of good materials and sufficiently wide to handle the traffic, can take care of two hundred vehicles per day without undue stress, if it is well maintained by the patrol system with an intelligent use of the road scraper and road drag. With an increase in the intensity of traffic, the dust nuisance becomes intolerable, and the road develops pot holes faster than the patrol men can fill them up.

Surface treatment, if it can be successfully worked, seems to hold out the only hope of holding the gravel road under increased traffic. When the cost of replacing the gravel road with some more resistant type is considered, it will be found that a very considerable annual sum can be expended on a gravel road rather than to spend the money to reconstruct it. According to the type considered, the interest on the new construction,

^{*}Paper before the American Society for Municipal Improvements.

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AT THE LEFT IS SHOWN A GRAVEL ROAD IN MAINE AFTER THE SPRING THAW, SHOWING THE EFFECT OF FROST WHERE THE BASE IS NOT WELL DRAINED.

BELOW IS SHOWN THE USE OF A DRAG IN PREPARING A GRAVEL ROAD FOR BITUMINOUS SURFACE TREATMENT.

the depreciation, and the upkeep will total \$2,000 to \$4,500 annually, which could well be expended on the gravel road rather than to replace it.

WHEN SURFACE TREATMENT IS DESIRABLE

As long as a gravel road is giving reasonable satisfaction with good dragging and patrol maintenance, it should not be surface treated, since the maintenance by surface treatment is more expensive until the traffic reaches a point that warrants its use.

Surface treatments should never be attempted unless provision is made beforehand to insure proper patrol or gang maintenance. Their economy and success depend on proper daily care. It is less expensive to let the gravel road go to pieces in the first place than to surface-treat it and then let it go to pieces.

The application of bitumens on gravel may be divided into three groups:

The application of dust-laying oils.

The formation of a bituminous mat.

The formation of a bituminous crust.

The application of dust-laying oils may be resorted to on any type of gravel road. Subsequently, the road is maintained by the ordinary dragging and patrol methods. It must be remembered, however, that the oil destroys the natural bonding quality of the gravel and that in wet weather the oil forms an objectionable greasy mud.

The second method, the formation of a mat or carpet coat with heavy bitumens, either tar or asphalts, is rarely successful, since the mat is not thoroughly supported by the gravel surface and quickly breaks under traffic and scales off.

The third method, of forming a bituminous crust which does not form a separate layer but is anchored firmly into the gravel, has given the greatest success. In this work the refined tars used cold have been especially valuable. They penetrate into the gravels easily and harden just sufficiently under traffic to make the process suc-



cessful. A material that does not harden eventually produces a wavy surface. Such a surface treatment can be successful only on a road capable of sustaining the crust under the traffic conditions imposed. Needless to say, it must be built of good gravel well drained, of proper strength and of a width adequate for the traffic. Treatments on one-track roads are not advisable. If they are adequate for the traffic, they do not need surface treatment. If they are not adequate, they should be widened.

The success of the surface treatment depends so much on the original construction of the road that it may not be out of place to give some of the principles involved.

PRINCIPLES OF GRAVEL ROAD CONSTRUCTION

Gravel in road construction should mean a material containing fragments of stone resulting from natural causes, usually water or glacial action but also in the Southern states selection by weathering through long periods of time.

The stone fragments are usually in a more or less completely rounded form and are particularly valuable in the road since they generally represent the hardest part of the country rock, since the softer parts have been destroyed in the formation of the gravel.

In selecting gravels for road work, it should be

the policy to use deposits that contain 60 per cent of stone held on a $\frac{1}{2}$ -inch screen and passing a 2-inch screen. The best gravels have the stone well graded in sizes and the part passing the $\frac{1}{2}$ -inch screen is also well graded with not more than 15 per cent passing a 200-mesh sieve.

The finer or binding material may be clay, but often fine particles of other rock like trap rock make efficient binders. Sometimes iron is present in a form to make a binder. A good index of the binding quality of the gravel is its behavior in the pit. If the gravel stands in a wall it will usually bind in the road. This test does not preclude an excess of clay binder.

Clay and other slime-forming constituents must be at a minimum, not over 15 per cent for roads that are to take a bituminous surface treatment, since emulsions are formed with the bitumens and the treatment soon sloughs off in wet weather.

If the gravels are not naturally properly sized, changes may be effected by screening to remove an excess either of large or small sizes. The waste may often be utilized in the base. Over clayey soils a layer of fine sandy material will keep the clay from working up into the gravel.

Some gravels are only rendered suitable by washing, but as this is an expensive process, it is not usually possible to resort to it.

Instead of screening out the larger pebbles, it is sometimes advantageous to run the whole out-

put of the pit through a crusher, thus utilizing everything instead of rejecting a large per cent of oversize pebbles. With the New Hampshire gravels this has been signally successful and has added but little to the cost.

As the object in building gravel roads in most localities is to get a road of low cost not greatly in excess of a dirt road, too much modification of the gravel is not justified. Every step in the handling and transportation of the gravel should be carefully thought out and planned. With unmodified gravels, the handling and transportation of the gravel are the main items of cost in the road.

The preparation of the road bed to receive the gravel should be thorough. Drainage, good alignment and proper width should be provided. Gravel roads, it is true, are cheap roads, but satisfaction in their use depends much on making them traversable throughout the year, and safe for the traffic that goes upon them. Even more than higher type roads, they are dependent on good drainage. A road is only as good as the worst place in it.

The width of the road should be ample. The easy maintenance of the road requires that it should be wide enough to distribute the traffic. Nothing less than eighteen feet should be considered for any road that is of importance.

The road bed may be prepared to receive the gravel either by what is called the trench method or by what is called the surface method. In the trench method the gravel is deposited in a trench prepared of the width and depth required of the road. In the surface method the gravel is placed on the leveled surface and allowed to thin out on the shoulders to nothing. A combination of the two methods may also be used.

The surface method has the advantage of better protected shoulders for the same amount of gravel used.



ABOVE IS SHOWN THE APPLICATION OF REFINED TAR TO A PREPARED GRAVEL SURFACE BY MEANS OF A PRESSURE DISTRIBUTOR. AT THE RIGHT IS THE SAME ROAD SHOWN AT THE TOP OF THE OPPOSITE PAGE, AFTER HAVING RECEIVED A SURFACE TREATMENT OF TAR.



Whatever scheme is adopted, the base should be true to line to ensure a uniform depth of gravel. The gravel should be put in in layers not over six inches to the layer. Each layer must be carefully leveled off and consolidated before the succeeding layer is applied. Methods of dumping and handling should be adopted that do not allow the gravel to lie in conical piles that are leveled off. The conical piles segregate the gravel, make it compact unevenly and produce a road that has humps throughout its life.

If different grades of gravel are produced in the pit, the best only should be used in the top layer. The specifications of the American Society for Municipal Improvements are explicit on this point and can well be followed where screened gravels are employed.

The final crown of the road should be about three-quarters inch to the foot, but where bituminous treatments are to follow, this should be reduced to one-half inch to the foot. An excessive crown on a bituminous surface tends to slipperiness and is not needed either to compensate for the wear or to shed the water quickly.

The consolidation of the gravel is often left to traffic. The best practice would indicate that rolling is necessary to consolidate the lower layer, and while the final hardening must take place under traffic yet it is much expedited by rolling. The old-fashioned horse roller built with sectional rings is particularly useful in this work.

MAINTENANCE

After the road has been opened to traffic, much care is required. Patrol maintenance should begin at once with dragging or honing after every rain. The end desired is to have the road retain the desired shape while the gravel consolidates. If the road is neglected, ruts are formed and the gravel is pushed out of shape and even out of the road.

The best way to take care of a gravel road is by good patrol maintenance. A good, intelligent man is given control of three to eight miles of road and spends his time under intelligent instruction and supervision in taking care of the stretch. He fills ruts and depressions from store piles of the self-same gravel used in constructing the road. He keeps the drainage open. He cuts the weeds and keeps the shoulders up. He drags the road after every rain. In the spring he may receive help with a grader crew to claw his road back into shape after the spring break-up.

Unless the road authorities are prepared to employ such men and encourage them, the citizens cannot expect good roads.

If the traffic becomes so great that there is a dust nuisance, and the patrolman finds it impossible to keep ahead of the pot holes, the subject of surface treatments should be considered. It is not an easy subject and if no local experience points the way, the advice of those who have successfully worked out the problem should be sought.

The refined tars applied cold have given good results on high-class gravel roads when intelligently applied and when proper maintenance is given. Gravel is not a uniform material and un-

less the breaks that occur are taken care of, the treatments are neither economical nor successful. The cost will be more than the usual patrol maintenance costs, but the cost of the refined tar is offset to some extent by the elimination of dragging and the saving of wear on the gravel necessitating less frequent renewals. Roads in hilly country are protected from washing, with a direct saving and economy after flooding rains.

SURFACE TREATMENT METHODS

The gravel roads are prepared for the treatment by shaping and dragging during the spring. If new gravel is added, it should not exceed a depth of two inches and should be added as early in the spring as possible. Heavy additions of gravel should be made in the fall, and new gravel roads should not be treated until they have weathered a winter and been carefully reshaped in the spring.

The road should be treated in the spring as soon as it is firm and solid. In New Hampshire and Maine, the roads are usually ready about the middle of May, but there is considerable seasonal variation.

Sweeping is usually but not always necessary. Only the dust should be removed and care should be taken not to loosen the gravel.

The refined tar is put on cold, or only warmed slightly to 100 or 120 degrees Fahrenheit. The best results are obtained by mechanical sprayers putting on two coats. The first is of four-tenths gallon, which is allowed to dry in without cover, which usually takes six to twenty-four hours in dry, sunny weather. The second coat of three-tenths gallon follows. If this is not quickly absorbed, it is covered with just enough coarse, sharp sand or fine gravel to prevent the bitumen from picking up on the vehicle wheels.

After the work has been completed, the road should be given careful patrol maintenance. Breaks will develop over soft spots in the gravel, and these must be patched with a mixture of gravel and refined tar. The patrolman should be supplied with four to ten barrels of refined tar per mile at convenient spots for this work. As soon as the first batch of weak spots has been eliminated, a good gravel road requires comparatively little attention, even under heavy traffic. The trunk highway between Portsmouth and Portland carries two to three thousand vehicles per day on this construction.

The treatment usually carries a road through the winter, but whether it breaks up during the spring depends on the road construction, the traffic and the weather conditions. After a hard, snowy winter, the road is not likely to break, but after a soft, open winter, it is quite sure to act like an ordinary gravel road.

If it does not break up, it is given a further treatment of about one-quarter gallon per square yard, and this usually requires a cover of sharp sand or small gravel, using about one cubic yard to three hundred square yards of area.

If the road breaks up, it is treated like any other gravel road—shaped up and dragged back into shape. The time when this can be done is short, and it is necessary to work quickly. If the road

once hardens, ordinary road machines have little effect on the surface.

The re-shaped road is then re-treated. Usually one-quarter to one-third gallon per square yard will be found sufficient to restore the surface and carry it through the season.

Roads that do not in themselves break up may, after a few seasons, become rough through frost displacement or through poor maintenance. A road becoming rough should be broken up in the spring. The road roller with a steam scarifier are efficient tools for this purpose. After breaking, the road is harrowed back into shape and re-rolled. It is then given a treatment of refined tar and treated like the road that has broken naturally. The refined tar in the road sticks the gravel together in chunks to some extent, and the road often is smoother and wears better than ever before.

The cost of breaking up is not excessive; in Maine it was under \$200 per mile for an 18-foot road previous to the war.

The scheme which has been outlined for extending the usefulness of gravel roads must not be misunderstood. It does not produce roads

which are capable of standing the punishment of higher-class roads. They are not adapted to heavy, all-the-year-round traffic, but they are adapted to a light winter traffic and during the summer will stand up under heavy touring traffic.

Where heavy winter and spring traffic exists, this type of road will not answer, and macadam, bituminous macadam, or even a more expensive type, will prove more economical.

If, however, the gravel road can be made to stand the traffic by an expenditure of even \$1,000 to \$1,200 per mile per year, it is justifiable, rather than to build a higher type at prevailing prices and high interest rates. A \$20,000 per mile type costs yearly in the neighborhood of \$2,500 for interest, depreciation and upkeep; and a \$40,000 per mile type may be rated at \$4,500 per year for the same charges. From these figures, road engineers are justified in giving close study to the problems of the cheaper class of roads. The road propagandist has made many an engineer forget that even under the most favorable conditions the gravel road mileage built is going to exceed, for years to come, that of any other type of surfaced road.

Gravel: A Plea For Common Sense Specifications

By Wallace F. Purrington*

The author believes that gravel is found with such variable characteristics, and that expensive sorting is so impracticable, that field inspection of the gravel by the engineer is more reliable for securing good roads than any possible laboratory tests of samples. He submits specifications based on this idea.

In drawing up any specification to cover gravel used in road construction, there are certain facts which must be kept in mind. The foremost question of all is, are the specifications workable? A theoretical specification based on laboratory findings alone may be very impracticable in the field, owing to the fact that the deposit from which the samples were collected is not homogeneous, so that the samples tested do not fully or accurately represent any large part of the deposit. In the second place, specifications may work well or badly according to whether or not the purchaser has the equipment or technical knowledge to check up the different items of composition in the specification.

At the present time most specifications covering gravel are (to the writer's mind) very ambiguous and wholly impracticable to put into operation. Many states make a practice of using screened gravel, but for the expense involved and the results obtained, New Hampshire, and it has many miles of very good gravel road, has found this procedure unnecessary. If the manipulation

of run-of-bank gravel is properly supervised, the results obtained are equal to those with the screened material. In the first place, gravel usually is defined as the material passing a 3½-inch screen; then a ¼-inch screen is interposed and two distinct sizes of material are separated. The material retained on the ¼-inch is arbitrarily called gravel or coarse aggregate and the material passing it is called sand or fine aggregate. Specifications commonly attempt to set limits to the ratio of gravel to sand which shall be such as to guard against the gravel being too sandy on the one hand or too cobbly on the other. This might be very satisfactory if gravel deposits were generally uniform and homogeneous in texture; but that is not the case, the gravel deposits which are most abundant and accessible all through the Northern states, deposits left by flooded rivers during the closing stages of the Ice Age, are notably heterogeneous in structure and texture. The long, narrow ridges or "eskers" of the New England states, and the shorter, interrupted ridges and hummocks of gravel, called "kames," show abrupt variations in the deposit, from the fine sand to coarse, cobbly gravel, both in vertical

*Chemist and Testing Engineer, State Highway Department, Concord, N. H.

section and lengthwise; so that a sample taken at one level or at one point may give a very incorrect idea of the average run of gravel from the face of the bank, and is no guide whatever to the quality of material that will be found 50 or 100 feet farther in. These banks were built by rivers running through and out from the melting ice sheet, where great floods during warm days or weeks alternated with sudden droughts when severe cold waves checked the wastage of the glacier. This spasmodic behavior of the glacier rivers accounts in large measure for the variability of the material in most "bank" gravels. Even the wash plains and valley-terrace gravels which accumulated beyond the reach of the ice sheet show too much variation in texture, both vertically and horizontally, to yield samples that would afford an adequate basis for judgment in the laboratory of what can so readily be seen in the field. A demonstration of this fact, by a study of scores of samples from a single deposit, has been given by Reinecke and Clarke in a paper entitled "The Sampling of Deposits of Road Stone and Gravel in the Field," and published in the Proceedings of the American Society for Testing Materials, Vol. 18, part 2, 1918. Their conclusions were summed up as follows:

"A large variation was found between results of duplicate granulometric laboratory analyses on the same sack of gravel. The variation in texture over one deposit of gravel of 800 acres was found to be large."

An inspection of almost any bank in New Hampshire will illustrate the truth of the foregoing statement, and the futility of depending upon a single sample or many samples to pass judgment on a given deposit. The desired result is far more likely to be gained by making the texture (coarse or fine) and grading (uniform, streaky, etc.) matters for field inspection by the engineer in charge, and leaving the laboratory to test only the resistance-to-wear of the gravel. Assuming then that the material is composed of hard, durable stones, the rather over-worked phrase, "such as will meet the approval of the engineer," can be well used. This means more for the proper construction of gravel roads than any theoretical grading system that may be adopted.

In New England and the Northern states, three sorts of material usually compose the gravel pavement of a road; gravel, sand and till (which last is commonly called "hard pan"). According to the proportion in which two or more of these are combined, such roads should be designated as "sand-gravel," "till-gravel," or "sand-till-gravel" road. The choice as to which type of gravel road is to be built will depend largely upon the material found in the sub-grade. The finer material is added to fill the voids in the coarse aggregate, and acts as a binder. The state, being the purchaser, may well tell the contractor whether clay, till, or sand shall be used. It might also say that the base course shall be of gravel, the larger stones predominating, and that the wearing or top course shall be such that much smaller stones shall predominate. This sort of statement is

comprehended by all parties interested. The engineer, inspector, contractor, or government representative has an intelligent basis from which to draw conclusions and a far more honest statement than could be obtained by a chance sample showing that 59 or 63 per cent is retained on a $\frac{1}{4}$ -inch screen. Such a specification is not only misleading, it is positively absurd.

The soundness or durability of the stone comprising the aggregate is, however, a matter of considerable importance. Fortunately, we have a rational method of gauging this in the Rea modification of the DeVal abrasion test as described in the Bureau of Public Roads Bulletin No. 555, page 30. By this test it is possible to place certain arbitrary values which ordinarily should not be exceeded.

A few outstanding facts will serve to summarize what has been said concerning gravel specifications: (1) The greatly increased demand by the public for good roads cannot be met, in every community, by adopting the heavier and more costly types of construction. Gravel and earth roads must still be very generally built, and local materials thus used. As the item of screening of gravel is quite costly we may well consider its elimination, as the question of its efficacy is open to question. (2) Specifications for the material to be put into such gravel roads must be plain and straightforward; so far as grading is covered, the specifications must be based upon what a reliable engineer sees at the pit where the deposit is fully exposed; not based upon the laboratory screening test of a sample or a group of samples, from a deposit which in all probability varies greatly in texture. (3) A laboratory test of the per cent of wear of the coarse aggregate, according to the Rea-DeVal test, should be made a part of the specification, to insure that the material consists of sound, durable stones. (4) The character of the fine aggregate or matrix should be left to the judgment of the engineer. (5) A little theory mixed with a lot of common sense, is better than the reverse.

With these points in mind, after conducting an extensive field and laboratory survey of gravels, the state of New Hampshire has adopted the following specifications:

MATERIALS FOR GRAVEL PAVEMENT

Gravel is to be understood to be a water-laid, stratified deposit which consists of rolled and rounded stones accompanied by sand and clay in varying proportions. The stones (or coarse aggregate) shall be hard and sound and well assorted, in sizes up to but not exceeding three and one-half ($3\frac{1}{2}$) inches in long diameter. The resistance to wear shall be determined by the modified abrasion test described in Bulletin 555, page 30, of the U. S. Department of Agriculture, Office of Public Roads; and the gravel thus tested shall be classified as follows:

Class A, Hard gravel under 7 per cent wear.

Class B, Medium hard gravel from 7 to 10 per cent wear.

Class C, Medium soft gravel from 10 to 15 per cent wear.

Class D, Soft gravel above 15 per cent wear.

Classes A and B may be used for either or both base or surface course. Class C will not be used for surface course and gravel of D quality will not be used except by written permission of the Commissioner.

The texture (coarseness or fineness) of the aggregate from any source or supply of gravel shall be such that it shall meet the written approval of the Commissioner. No

gravel shall be used until a complete report has been made by the Engineer regarding its qualities, and the approval of the Commissioner has been obtained specifying the class of work for which its use is approved. The approval shall be furnished on a form which shall contain the following information:

1. Account to which work is to be charged.....
(Town)
2. Nature of material, gravel, sandy gravel, sand, till, clay.
3. Source of material
(Local name) (Location)
4. Type of material, gravel, gravel-till, gravel-clay, sand-clay.
5. Contractor or Foreman
(Name) (Address)
6. Grading of pit (Visual inspection) (Check the description which best fits the case.)
 - (a) Uniform and well graded, large stones predominating.
 - (b) Uniform and well graded, small stones predominating.
 - (c) Streaky or poorly graded, coarse aggregate predominating.
 - (d) Streaky or poorly graded, fine aggregate predominating.
 - (e) Sandy with only a small amount of coarse aggregate.
 - (f) Cobbly with only a small amount of fine aggregate.
7. The Laboratory has reported on a sample submitted from this source under Laboratory Number..... to be..... per cent of wear and is rated as Class..... gravel.

Engineer.

This is satisfactory material and may be used in the base, surface course.

Commissioner.

By.....

These blanks shall be executed in quadruplicate, one copy to be furnished the contractor, one copy to the Office of Public Roads, one copy to the Commissioner and one copy to be retained by the Engineer.

It is understood that the Engineer may order the Contractor to cease operation in any pit when in his judgment the size of aggregate is not suitable for the type of road construction under consideration.

Gravel Roads in Arid Country

That a gravel road, being water-bound, should not be laid in an arid country, but that sand-clay is better for such conditions, is the opinion of Lamar Cobb, for six years state highway engineer of Arizona

To build a water-bound pavement in a country where nature furnishes no water would appear to be self-evidently impracticable and unreasonable, and yet such roadway surfaces are being built in the arid sections of our Southwest. This matter was discussed in a communication sent to this paper recently by Lamar Cobb, who was state highway engineer of Arizona from 1912 to 1918 and who has had an experience of more than ten years in highway work in both arid and non-arid climates, but especially in the former. The following is a more or less abbreviated statement of the points brought out by Mr. Cobb.

The effect of low precipitation—from 2 to 25 inches of rainfall annually—on the life and maintenance of water-bound road surfaces in the arid and semi-arid sections of the Southwest has not received proper consideration by highway engineers. Water-bound roads include not only water-bound macadam, but also gravel, sand-clay and native soil. Water used in constructing and that supplied by rain or atmospheric moisture, tends to evaporate and be absorbed by the ground below, the length of time that the moisture is retained and performs its functions as a binder being dependent upon the aridity of the climate. A water-bound gravel road in an arid climate cannot be maintained by the use of the grader or drag, since there would be no moisture for reconsolidating and recementing the earth and other fine matter which serves as a binder. The surface soon becomes roughened by the removal of the clay and small stone by winds and vehicles. It can be resurfaced only by periodic scarifying or ploughing, harrowing and reshaping during the winter season, consolidation being effected by traffic, for the expense of sprinkling and rolling would be prohibitive.

The idea sometimes suggested of sinking wells and using the water for supplying the moisture required to bind such roads is impracticable, even were the water obtainable at reasonable depths, for there would still be no moisture in the sub-base or in the base, and consequently to keep the surface moist it would be necessary to sprinkle it continually, the cost of which would be impossible.

In such a country a gravel road will not last more than one or at most five years, and yet many miles of such roads are now being constructed and paid for by thirty-year bonds. Highway engineers are becoming well acquainted with the highly objectionable features of issuing bonds having a longer life than that of the road to be constructed by the proceeds from them.

In the East, water-bound macadam and occasionally gravel are used to advantage as base for a comparatively thin wearing surface of bituminous material or brick, but such construction would be an unnecessary expense in arid sections, according to Mr. Cobb, since no sub-base is necessary, there being no water in the soil to soften it, but the whole sub-base being one homogeneous, unyielding stratum.

The greater the proportion and the smaller the size of the fine binding material in a road surface in arid countries, the longer will this surface retain moisture, and the more readily can it be maintained. This being the case, for such a climate a sand-clay road with its 30 per cent of clay binder and 70 per cent of sand is more suitable than a gravel type of road with 10 per cent clay binder and 90 per cent gravel. The sand-clay road will wear more rapidly but furnishes at all times a smooth riding surface, which the gravel rarely does for longer than one year. Gravel roads are being built in the Southwest at a cost of approximately \$10,000 per mile, while a sand-clay road can be built for half that sum, or less. Moreover, where gravel deposits are found, there is likely

to be also both sand and clay, either separate or mixed in approximately the right proportions. There are miles of roads traversing sand-clay country where it is only necessary to install the necessary cross-drainage structures and crown up the road to a higher grade or, in the case of low ground, surface with high-ground materials to be found near at hand.

Neither sand-clay nor gravel will be durable in or near villages or other centers of population. But the considerable amounts saved by constructing sand-clay instead of gravel in the country districts will be sufficient for constructing a more durable type of pavement within and for the first mile or two outside of the towns and villages which the roads connect.

Gravel Roads in West Virginia

Following a recent inspection of Federal aid projects in several counties of West Virginia, B. E. Gray, senior U. S. highway engineer, said that he found excellent gravel surfacing 10 inches thick being put on at 50 cents a square yard. It is planned to give this gravel oil treatment in 1921, at a cost of 15 cents a square yard, which will give a road surface adequate for local conditions and which compares most favorably with other types costing considerably more than 65 cents.

Kansas Must Legislate For State Roads

On account of a provision in the Constitution of the state of Kansas whereby "the state shall never be a party in carrying on any works of public improvement," an amendment has been prepared and will be voted upon November 2, permitting the state to extend aid amounting to 25 per cent of the cost of building roads, provided the aid extended to them shall not be in excess of \$10,000 for each mile of road built.

It is expected that such state aid will not involve state taxation but will be derived from motor car license fees. This amendment is stated to be the only measure by which the entire state of Kansas may receive material aid in good road building and should the amendment fail on this vote it is doubtful if the next legislature would take it up again.

Restricting Motor Truck Traffic

The public service commission in Philadelphia has recently refused to issue convenience certificates permitting heavy trucks to use the Lincoln Highway between Philadelphia and New York because that thoroughfare is already badly cut up by these heavy vehicles and it is believed to be questionable whether they should be permitted to travel over it. An investigation is now being made of the conditions of the roadway and of the corporations or individuals operating on it without a license, which will probably lead to regulation of the weight of trucks permitted. Until this investigation is completed, no more certificates of convenience will be granted for the operation of any motor trucks on the Lincoln Highway between Philadelphia and Trenton.

Surfacing Old Cobble Pavements

Describes how Danville, Va., prepares its old cobble streets for surfacing and applies a mixture of asphalt, stone and chips, securing a smooth pavement at a total cost of about 65 cents a square yard.

Despite the high price and scarcity of cement and other building and paving materials, Danville, Va., is securing some very good pavements at extremely low prices. Danville is an old city and has about ten miles of streets paved years ago with cobble stones. Under the direction of Ralph K. Linville, the city engineer, these cobble pavements are being turned into smooth and durable ones suitable to all but the heaviest traffic of the city. The cost of this averages about 65 cents a square yard for the completed work. Mr. Linville considers that only about half of the ten miles of cobble streets can be treated satisfactorily in this way without costing considerably more than this, and this resurfacing is being done on only those streets which are of even contour, fairly smooth and on light grades.

The first work of this kind was done last November, soon after Mr. Linville became city engineer, and is therefore a little over seven months old. It is at present in very good shape, the only objectionable feature evident being softening and creeping during hot weather, which is probably due to the use of asphalt with too high penetration—130 to 150. On more recent work the penetration has been lowered to 100 to 120 and on these streets this trouble has not developed.

The old cobble streets have their joints pretty well filled with an accumulation of dirt in which more or less grass and weeds are growing. In preparing the pavement for the new surface, the grass and weeds are carefully removed, all loose dirt is swept off, and the pavement is then thoroughly washed with a fire hose under city pressure. This washing removes the sand and dirt from the joints between stones to the depth of about an inch, furnishing a bond for the surface treatment. After the street has dried out it is covered with a coat of half-inch to inch stone which is spread and raked to an even surface and then lightly rolled. On this is applied a coat of Burmudez asphalt, using about three-quarters of a gallon to a square yard, which is immediately covered with a coating of stone of one-quarter-inch to three-quarter-inch size, which is spread thickly enough to take care of the surplus asphalt and leave a small amount of loose stone in addition. This fine stone is thoroughly rolled and a second coat of asphalt of one-half gallon to the square yard is then applied and immediately covered with a coating of stone chips sufficient in quantity to take up any excess asphalt, and the street is again thoroughly rolled. This gives a

smooth pavement with a minimum thickness of about an inch over the cobble stones.

The pavements built in this way and now in use closely resemble asphalt macadam. The undisturbed cobble stones which have carried years of traffic give a solid foundation. The work is done with city forces and has averaged a little over 65 cents a square yard, with stone costing \$4 per yard.

Mr. Linville does not expect these pavements to last under heavy traffic but believes that they will last two years or more in outlying or residential sections where the traffic is light, before needing resurfacing or substantial repairs, and that they give a very decided improvement at low cost.

Better Highways For North Carolina

A large and enthusiastic meeting was recently held in Wilmington, N. C., under the auspices of the Chamber of Commerce, Kiwanis Club, Rotary Club and the president of the North Carolina Good Roads Association, at which a very strong plea was made for the governor and legislature of 1921 to provide necessary ways and means for laying out, constructing and maintaining a modern system of highways, interconnecting and interjoining the county seats and principal towns of the state.

It was shown that the state has taxable property amounting to three and one-half billions,

banking resources of about 400 million dollars, and agricultural crops of more than one and one-half million dollars last year and that the present system of roads is so bad as to amount to the imposition of an annual mud tax of 100 million dollars. It was estimated by one speaker that, if the railroads were required to improve their lines 100 per cent and the necessary highways were built to support them, the shipments of manufactured and farm products during the next ten years would double the state wealth.

Progress on Iowa State Roads

The latest report of the Iowa State Highway Commission shows that notwithstanding the very great obstacles that Iowa, in company with other states, has experienced in road building this season on account of scarcity of labor and materials, there has been completed this year 14.1 miles of paving on Federal aid road building projects which total 137.9 miles of paving. There has also been completed 20 out of 150 miles of gravel road and 283 out of 556 miles of grading.

Especially good progress was made in July, when there were completed 6 miles of paving, 11 miles of graveling and 44 miles of grading. Scott county is considered to lead in having let two contracts, each of them for more than 5 miles of brick paving. The paving is being done with wet concrete hauled to the sites from central mixing plants. Throughout the state large use is made of mechanical road building equipment.

The A. S. M. I. St. Louis Convention

Narration of the doings of the twenty-sixth convention of the American Society for Municipal Improvements. Discussion of the society's finances results in increase in dues. Change in system of committees. Reports of committees on paving specifications.

A program apparently adjustable to fit the conditions, an entertainment committee so thoroughly organized that everything went like clockwork, audiences of comfortable size and reasonably prompt in gathering and perfect weather joined to make the St. Louis Convention of the American Society of Municipal Improvements one of the most notable in its history. About three hundred members and guests signed the convention register.

The program, printed a month before the convention and carried out almost to the letter, had three or four outstanding features.

The session of Tuesday afternoon was rather miscellaneous in its nature and had papers of interest to almost all classes of members. That of Wednesday morning was a gathering of the experts in sanitation, sewage and waste disposal and sewer construction, the advances in the ac-

tivated sludge process being brought out in particular in the papers by Langdon Pearse, of the Chicago Drainage District; Edward Bartow, formerly of the Illinois State Water Survey, and discussion by T. Chalkley Hatton, of Milwaukee, and J. C. McVea, of Houston, Tex. Wednesday evening was a notable program for the City Planners and drew an attendance of St. Louis citizens interested in the work of that city. St. Louis, Washington, Pittsburgh and the replanning and reconstruction of French cities and towns received most attention.

The long program of papers on paving was almost completely cleaned up in the two sessions of Thursday, including the discussion and passing to letter ballot of a few changes in the standard specifications and some new specifications for curb and gutter.

Traffic and transportation were covered on Fri-

day morning by Prof. A. H. Blanchard's report and papers by Henry G. Shirley on the proposed uniform vehicle law, by Robert Hoffman on widths of roadways on various classes of streets and roads, and by R. C. Barnett on the relations of pavement foundations and economic transportation.

The officers elected were Col. R. Keith Compton, of Baltimore, president; E. S. Rankin, of Newark, first vice-president; W. W. Horner, of St. Louis, second vice-president; E. R. Dutton, of Minneapolis, third vice-president; Charles Carroll Brown, of Valparaiso, Ind., secretary, H. H. Smith, of Brooklyn, N. Y., treasurer; Frederick A. Dallyn, of Toronto, C. Arthur Poole, of Rochester, and S. Cameron Corson, of Norristown, Pa., finance committee.

Baltimore was chosen for the next convention.

SECRETARY'S REPORT

The report of the secretary showed some growth in the society, the number of members being 612; the society having recovered to the same membership and receipts of money as in 1916, before the intermission caused by the war. The general expense of operating the society has been decreased in the four years, but the cost of printing has increased so much that the total cost of operating the society for the year was about \$1,650 more than the receipts. The bids for next year's printing being considerably greater than for this year even, it was deemed necessary to increase the dues 50 per cent to prevent an actual indebtedness or a serious reduction in the character of the service to members, and an amendment to effect this was adopted.

Inspecting the secretary's report more in detail, we find that during the year from September 30, 1919, to September 30, 1920, there were admitted to the society 78 active members, 7 affiliated members and 45 associate members, while there were lost during the year 47 active, 5 affiliated and 11 associates; giving a total membership at the end of the year of 457 active members, 24 affiliated and 130 associate.

The receipts of the society comprised \$1,764.50 active members' dues, \$97.50 affiliated dues and \$972.30 associate dues; \$252.23 for Proceedings sold; \$28.37 for specifications sold; \$652.81 for advertisements, and \$4.11 miscellaneous; to which should be added \$31.87 interest on Liberty Bonds owned by the society.

The expenditures included \$128.75 for office stationery and printing, \$15.71 telegrams and exchange, \$180.47 postage, express and freight, \$600 for office clerk, \$10.50 treasurer's expense, and \$15.15 for office supplies; a total of \$950.58 for office expenses. For convention expenses there were paid out \$504.41; for specifications \$56.50, and for publishing and sending Proceedings \$2,496.31. The society still owes the printer \$1,330, and the secretary's salary of \$300 was not collected during the year. Aside from the printing of the specifications, most of the items of expense are less than last year, while the receipts were nearly \$500 greater than last year and about

\$1,000 more than in 1918. However, the cost of printing and distributing the Proceedings, including the advance papers, was so much greater that the total expenses considerably exceeded the year's income. A comparison of the expenses and income for the four years past was made by the secretary in the following tabular form:

Comparison of Expenses and Income for four years:

	1916-17	1917-18	1918-19	1919-20
1. Total Expenditures	\$4,461.99	\$2,061.39	\$3,848.74	\$5,637.80
2. No of members	606	543	544	612
3. Total expense per member..	7.36	3.80	7.07	9.21
4. General Expense	2,474.69	1,311.28	2,183.34	1,811.49
1. General Expense per member	4.08	2.42	4.02	2.96
6. Cost of Proceedings and Advance Papers	1,987.30	750.11	1,662.46	3,826.31
7. Cost of Proceedings and Adv. Paper per member	3.28	1.38	3.05	6.25
8. Income from dues	2,860.10	2,120.20	2,482.00	2,835.30
9. Income from dues per member	4.72	3.90	4.56	4.63
10. Other income	1,536.87	629.26	804.07	937.52
11. Other income per member..	2.53	1.16	1.48	1.53
12. Total income per member...	7.25	5.06	6.04	6.16
13. No. of pages of Proceedings.	740	240	448	726
14. Cost per page	2.69	4.38	3.71	5.27
15. Cost per copy (750 copies printed) including Advance Papers	2.65	1.40	2.22	5.10

This year the cost of printing the Proceedings, including typesetting, paper and presswork complete, averaged \$2.15 per page, while the cost for printing the 1920 Proceedings will be \$3.54 per page, including 50 cents per volume for binding. Assuming the same number of pages in the volume as this year, the Proceedings for 1920 will cost about \$3,300 and there would be a deficit next year of between \$2 and \$3 per member. It was to meet this anticipated deficit that the dues were increased 50 per cent.

AMENDMENTS TO CONSTITUTION

Another amendment to the constitution introduces a complicated system of sub-committees under chairmen who are members of a general committee covering several related subjects. Thus the committee on street paving, sidewalks and street design, street maintenance and street railway construction will have 13 members, five of the general committee and two additional members in each of the four sub-committees on street paving, on sidewalks and street design, on street maintenance, and on street railway construction. Also the city planning committee will have 13 members with four sub-committees on local subdivisions, on zoning, on utilities, and on parking and open spaces; the committee on street cleaning, refuse disposal and snow removal will have 10 members with three sub-committees on street cleaning, on refuse disposal and on snow removal, and the committee on sewerage and sanitation has 10 members with three sub-committees on sewerage, on sanitation, including sewage disposal, and on public comfort stations. The other eight general committees remain as at present with three members each. The committees on specifications were increased by two, one on foundations and sub-grades and one on street railway pavements, including track construction.

The resolutions adopted included one regarding M. J. Murphy, of St. Louis, the first president of the society, who died on Monday preceding the opening of the convention at the age of 87; one to promote the membership of the United States in the Permanent International Association

of Road Congresses; one approving the salary schedule for engineers in municipal employment adopted by the American Association of Engineers, and one commendatory of the committee on convention arrangements and its sub-committees for its most successful work in preparing for the convention and the perfection in its plans and in their fulfilment.

PAVING SPECIFICATIONS

The changes in the specifications for sheet asphalt pavements were presented practically as printed in the Advance Papers and make small changes in the requirements as to penetration tests, shaping and compacting foundations and wearing surface, on old foundations, methods of laying, plant for laying and testing. The committee recommended that next year's committee consider codifying the specifications to reduce their length, complexity and detail.

The committee on bituminous macadam, bituminous concrete, and asphalt block pavements recommended that the specifications for asphaltic cement in all the standard specifications for bituminous pavements be made uniform as to origin, general properties, and tests, with variations in certain details according to class of pavement and use of it, both as to asphalt and as to tar; that the various specifications for asphaltic or bituminous concrete be joined in one with variations with class and use, which can be done under present conditions.

The committee on broken stone and gravel roads made no recommendations of changes.

The committee on brick pavements presented changes providing for adequate sub-grade, underdrainage, for setting castings of sewer appurtenances on concrete foundation and not imbedded in it, for sand-cement cushion where properly graded sand cannot be obtained, the mixture to be 1 of cement to 4 of sand and 1 inch thick. A specification for asphalt filler of joints to be applied by squeegee was added.

The committee on cement concrete pavements made a few changes in the tentative specifications presented at New Orleans in 1919 and printed in the Proceedings of that year. The principal changes were in omitting the specifications for determining voids in aggregates, omitting the specification for sub-grade, that being left for the new committee on specifications for foundations and sub-grades, and omission of the entire specifications for a two-course pavement.

The committee on wood block pavements recommended an additional specification for special pitch filler to be used when bituminous cushion is used, which was printed in the Advance Papers.

The committee on sidewalk and curb specifications recommended for adoption the specifications for sidewalks adopted by the American Concrete Institute and printed in the Proceedings for 1919.

All the above specifications and changes in specifications were referred to letter ballot of the society.

The committee on sidewalk and curb specifications also recommended specifications for stone,

concrete and pre-molded concrete curb; the stone block pavement specifications committee recommended specifications for "Durax" paving blocks and pavement made from them and some changes in details of the existing specifications, which were referred back to the respective committees under the rules for publication in the Proceedings of the 1920 Convention and further discussion during the year and action at the convention.

The committee on sewer specifications presented specifications for materials for sewer construction for printing in the 1920 Proceedings and action at the next convention. They are Part I of the full specifications; Part 2, devoted to specifications for methods of sewer construction, to follow.

The committee on foundations presented the specifications for old and new macadam base, printed in Advance Papers, which were passed to letter ballot and tentative specifications for asphaltic concrete base and cold-penetration tar base, which will be printed in the 1920 Proceedings.

(To Be Continued)

Detroit Bridge Contract Modified

The city council of Detroit, Mich., has modified the form of contract for the Belle Isle bridge, bids for which were to be received on October 2. In view of the changes, the date for opening bids has been postponed to October 30. The modifications provide for a payment of 80 per cent of the cost of the materials for the bridge as soon as they are delivered on the job, and the payment of 90 per cent of the contract price upon the completion of each part of the work. It is believed that this should result in lower bidding. If this amendment had not been made, the contractor would have had to count on approximately \$3,000,000 paid for materials being tied up for several months.

Jersey City Water Department Strikers

Twelve trench diggers employed by the water department of Jersey City, N. J., went on strike a few days ago for an increase of pay from \$5 to \$7 a day, but after remaining out three days asked to be re-employed and were permitted to return by Commissioner Fagen.

Big Standpipe For Portland, Oregon

Plans for a new 1,000,000 gallon standpipe to be erected in the Vernon district were filed with the building department by Chief Engineer Randlett of the water bureau. The standpipe is estimated to cost approximately \$100,000, the contract having been let to the Chicago Bridge & Iron Company. It is expected that the new standpipe will be completed shortly after January 1.

The new water tank will replace the present 350,000 gallon Vernon standpipe, which will be moved to the St. Johns district, according to City Commissioner Mann, in charge of the water bureau.

Septic Tanks For Unsewered Districts

By C. Edward Keefer *

A considerable area recently annexed to Baltimore is without proper sewerage, and it is impracticable for the city to extend its sewerage system to all parts of it at once. It has therefore planned septic tanks such as are described in this article as standard temporary substitutes until the several sections can be served by the city's sewers.

The city of Baltimore in 1919 was enlarged from an area of 32.19 square miles to 91.93 square miles by the annexing of territory, a considerable area of which was not provided with sewerage. In the annexed territory there are many streams, both large and small, and the natural inclination in the past has been to dispose of the house sewage by discharge into these streams regardless of consequences. One of the foremost problems of the Sewer Division of the city since annexation has been improving the conditions thus created. In conjunction with the Department of Health, it has taken a decided stand in the matter, and wherever houses are not connected with the main sewerage system of the city but discharge their sewage water into the streams, to the detriment of the public, it will be insisted that some satisfactory method of sewage treatment be provided.

It is impracticable to immediately extend the city's sewerage system into all of this new territory, and to meet the situation the Sewer Division has designed a septic tank, various sizes being provided for units of from 10 to 1,000 persons. Buildings have been constructed during the past year, and apparently will continue to be, at such a rate that quite a number of these tanks will have to be provided. They are considered to be temporary only and will be abandoned later when the necessary trunk and lateral sewers have been built for conducting the sewage to the sewage treatment plant of the city.

In studying the problem of tanks for these small installations, much thought was given to the relative advantages and disadvantages of septic and Imhoff tanks. Experience at the Baltimore sewage disposal plant, which agrees in general with conditions elsewhere, has been that a great deal more supervision is required over Imhoff tanks than over septic tanks. With the best of supervision, Imhoff tanks are often very erratic, and with little or no supervision it is impossible to predetermine the results, and it is not expected that these small tanks will receive more than a casual supervision from the owner, although the city will do its best to keep in touch with the operation of them. Occasional analyses will be made of both the influent and effluent, soundings will be taken to determine the quantity of accumulated sludge, and the sludge will be pumped into tank wagons and carted away when necessary. Sludge from Imhoff tanks is more readily disposed of than that from septic tanks, but as it is to be carted away, this removes one of the chief reasons for using Imhoff tanks. Furthermore, Imhoff tanks practically always are more expensive to construct, as the excavation has to be carried to greater depths, the

details are more complicated, and a tank with more capacity must be provided.

In the Baltimore design, the larger septic tanks are based on a minimum flow of 80 gallons per capita per day, a detention period of 8 hours with a foot of sludge in the shallower end of the tank, assuming an operating period of 18 out of 24 hours. The outlet end is made shallower than the inlet so that less sludge will be carried out with the effluent because of the flotation by gas from the bottom sludge; the grade from the outlet to the inlet end varying from 4.4 per cent. to 16.6 per cent, the latter not too steep to permit a man standing up on it without slipping.

Tanks designed for more than 200 persons have two compartments, but otherwise the proportions of the entire tank are similar to those of the smaller, but the middle partition wall divides it into two tanks, each of which is twice as long compared to its width as in the case of the single tanks. In these double tanks, both compartments will be in operation under ordinary conditions, but one will be cut off during cleaning periods. The general proportions vary from a minimum of 6 feet long, 4 feet wide, 5 feet depth of sewage at the outlet end and 6 feet at the inlet end for ten persons, to a maximum for 1,000 persons of 46 feet long, 14 feet wide, 8 feet deep at the outlet end and 10½ feet at the inlet end.

The sewage enters through a 6-inch vitrified pipe, there being just inside the wall of the tank a T with the branch pointed downward and a plug in the end, which plug can be removed for the purpose of cleaning the pipe. Two and one-half feet from the inlet end of the tank is placed a wooden baffle across the tank extending 2 feet below the level of the sewage and 1 foot above it. Two and one-half feet from the outlet end is another baffle extending 1½ feet below the sewage level and 1 foot above it. The effluent leaves through a 6-inch vitrified T with the branch horizontal and attached to the outlet pipe, and the main line of the T placed vertical. The walls of the tank for all the sizes are made of concrete 8 inches thick and the bottom of concrete 6 inches thick, while the top is roofed with concrete provided with a hinged wooden door at each end, over the inlet and outlet, respectively.

If there should be need for a higher degree of purification of the sewage than the septic tank effects the effluent will be subjected to further treatment.

The sewerage of the city is under the general supervision of the Highways Department, of which August E. Christhilf is the head, with Milton J. Ruark, division engineer of sewers, directly in charge.

*Assistant designing engineer, Highways Engineer Department, Baltimore.

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Sewerage For Scattered Districts

One of the difficult problems for the sewer department in every growing city is that of providing sewerage for the outlying districts where population is so scattered that a long line of sewer would be needed for reaching each house, and the streets are as yet unopened so that the construction of sewers would be a difficult and expensive matter. A number of cities have adopted as the solution the use of the pail system, but more places require the occupants to solve their own trouble either undirected or under restrictions, such as insisting upon cesspools constructed and maintained according to prescribed regulations.

The city of Baltimore, as described elsewhere in this issue, finds itself faced with a problem of

this kind but of unusual magnitude, several square miles of territory being added to the city, some sections of which are provided with small systems of district sewers discharging at points where such discharge cannot be permitted to continue. It has, therefore, decided on a method of district treatment rather than residence treatment, and has adopted for this purpose the use of septic tanks of a standard design which has been prepared by the sewerage engineers of the city. This is considered as a temporary solution only, to be superseded by extensions of the city's sewerage system connecting with the large sewage treatment plant.

This might seem somewhat expensive for, a temporary measure, but it will unquestionably be much less so than would be the more common plan of requiring each resident to build his own cesspool, to be abandoned whenever sewers are extended to the property in question.

The question suggests itself whether it would not be possible to use some device for treating the sewage which, when it had played its part at one point could be moved to another which had developed still further from the main lines of the sewer system. Something in the nature of a tank or other device, constructed possibly of steel, even though its first cost might be greater than an ordinary concrete septic tank, would seem to meet such requirement. One of the desirable features of such a tank would be that the entire treatment be inclosed so as to be inoffensive to sight or smell, so that it could be established at any point that would be most convenient and economical in cost of operation. Such a tank might be of the general form of a "Kessel," or air-tight sedimentation tank, or a tank employing the electrolytic process, both of which have been described in this journal.

A number of such plants might be used in those cities (of which there are hundreds in the country) that have not yet extended their sewerage system over more than 50 per cent of even the well-built-up section, these plants being moved outward from time to time as the sewer system is extended to take their place. It does not seem probable that, once established, such a method of treatment would be more expensive than the pail system, and it would seem to be less objectionable to all concerned and more sanitary.

Increasing Society Dues

Many and perhaps most of the various societies of the country, technical and others, have recently been finding their incomes insufficient to meet their annual expenditures. Practically all of them look to the dues paid by their members for by far the largest part of their income, and the only solution of their financial problem appears to be increasing by 50 per cent or more either the dues or the membership. The latter does not seem practicable and the result has been that a great many of the societies have felt it

necessary to increase the dues, as was done last week by the American Society for Municipal Improvements.

And yet, a considerable amount of this increase might be avoided, in some societies at least, if all the members would pay their dues. In the society named, the accounts show that from 15 to 30 per cent of the members never pay their dues, being presumably dropped after a few years for non-payment. The writer knows of instances where men have joined the society and been retained as members for three years, receiving the publications and other benefits without ever having paid a single cent towards the society's expenses. If some method could be adopted for insuring the prompt payment of dues, it might be possible, in some cases at least, to avoid the increase of dues or at least greatly reduce it. In clubs it is the practice to post the names of those who are in arrears, and it would seem to be equally in order for a society to make public from time to time the names of those who refuse to respond to the repeated requests of the secretary that they pay their dues or other indebtedness to the society.

Immigration Notes

In Chicago, where there now are more than 700,000 foreigners, citizenship papers are being issued by the Federal authorities to the utmost capacity of their offices. The rush is explained by the chief naturalization examiner as due to three causes, namely, that the petitions for final papers made during the war are now coming due; that Poles, Russians, Germans and Slavs feel they have nothing to gain by returning to Europe; and that American business men are beginning to realize that it is safer to employ American citizens than to employ foreigners who may be radical.

The rapid increase in the arrival of immigrants at New York, which is the chief American receiving port, has entirely overwhelmed the facilities there so that on one occasion it was necessary to detain the aliens for 48 hours on board ship and not allow them to land until the congestion could be somewhat relieved. This rapid increase of volume has already swamped the immigration machinery, and plans are being worked out by the immigration bureau to relieve it by making full use of facilities for handling immigrants at Boston, Baltimore, Norfolk and gulf ports. It is considered possible that an extra session of Congress may be called soon after the November election to deal with immigration problems and although it is not agreed what course will be adopted, it is generally conceded that more care should be exercised by government officials at the port of embarkation to eliminate the undesirable class. As it is, a considerable number of idle and vicious, besides those afflicted with contagious diseases, arrive here and have to be returned, as well as very large numbers that arrive practically destitute and have not funds with which to proceed to the point of their destination.

The proper selection of immigrants by the official inspectors has already succeeded in materially checking the entrance of known radicals. But it is much more difficult to prevent the large increase in the number of immigrants officially classed as "industrial parasites," who, since the war, have been entering this country, not in search of work, but to escape work in their native countries.

A serious difficulty confronting the United States immigration authorities is the proper disposal of alien arrivals who, having heard of the enormous wages now paid in the Eastern states in shops, in factories and in mines, are so determined to share them that 75 per cent refuse to look for employment on farms and in the West, while in the ten years preceding this war the farming districts received more than half of the new arrivals. It is stated by the commissioner general of immigration that neither the Federal nor state laws provide for enforcing a proper distribution of labor.

At the second annual convention of the American Legion in Cleveland, September 29, a vote was taken recommending the abrogation of the existing agreement that limits the amount of Japanese that are now admitted to this country, requesting the exclusion of all Japanese immigrants and opposing the granting of naturalization rights to Japanese already in this country.

In the week ending September 25, 20,503 aliens were examined for admission at Ellis Island, including 16,005 steerage passengers almost exclusively of the immigrant class. Almost all of the second cabin passengers included in the remainder were also in the immigrant class.

On account of the overcrowding of the station, many of the inspections were held aboard ship and on the piers, and the eligibles admitted directly thereafter.

Commissioner Wallis has made temporary provision for decreasing the discomfort in the overcrowded Ellis Island quarters, and has under consideration considerable enlargement of the immigration station there to care for the great rush of immigrants which is considered as yet barely commenced. He states that the ocean ships have booked quarters for a year in advance to full capacity; that new ships are entering the transatlantic business and that one corporation has planned for 20 ships, some of them now under construction. He has been informed that 3,000,000 Italians and even more Germans are anxious to immigrate to this country.

The commissioner stated his determination that our selective immigrant test shall not be made elastic, no matter how great the rush of immigration. He considers it important that the law should be strictly applied and immigrants measure up to American standards and has notified every inspector and doctor not to be disturbed by the extraordinary increase in immigration, but to thoroughly safeguard the country against undesirables, considering that caution should not be sacrificed for policy.

A European Labor Alternative

Two radically different plans for settling the labor situation in Germany are described in recent dispatches from Berlin where a delegation of moderate labor leaders have presented a plan formulated to secure increased production in concert with government action which will make it obligatory for manufacturers to operate their factories continuously, with government guarantee against loss. This will secure government instead of politician control of labor and a special industrial condition will be created consisting of capitalists, technical men and labor representatives, their whole purpose being to conduct industry for the purpose of increased production, not for profit. This scheme has been carefully and thoroughly worked out and is intended to benefit the whole people and reduce taxes.

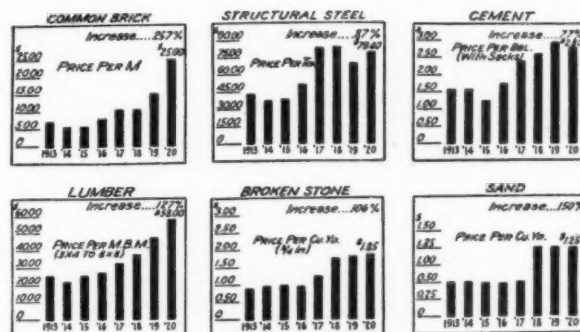
Diametrically opposite to this plan is that proposed by the German industrial leaders, namely, a gigantic trust including practically all manufacturers, that "may suspend production entirely for a while, closing down the whole country in order to get labor into a sensible mood," and thus enable the manufacturers to resume their pre-war profits that were paying them dividends higher than 30 per cent.

Construction Costs to Remain High

Conclusions from a study of the Fuller Industrial Engineering Corporation is that there will be no substantial reduction in building costs for several years to come.

A study of conditions as to building costs made by the Fuller Industrial Engineering Corporation, New York, leads to the conclusion that there is no material reduction of them in sight and that none may be expected for several years. In most respects this subject is as one with engineering construction and contract work, so that the facts and conclusions presented are valuable for consideration and are here summarized.

The report states that a reduction of building costs might be effected by either of three conditions, namely, a reduction in demand, a reduction in wages of labor, or a reduction in price of building materials. As it is estimated that the country is short about \$2,500,000 worth of deferred building construction alone, there is no possibility of a reduction in demand until this is made up. In order to make up during the present year the existing shortage in housing alone, it would be necessary to construct an aggregate floor area of 1,597,200,000 square feet, which would be almost as much as has ever been built in any three years. Besides this, there is an annual regular demand for more than 600,000,000 square feet of floors, which should be built in addition to making up this shortage.

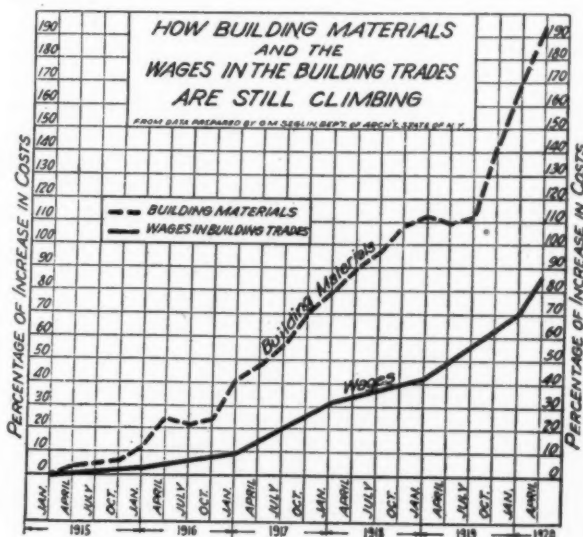


SPRING PRICES OF BUILDING MATERIALS IN NEW YORK FROM 1913 TO 1920

The average cost per square foot of building rose from \$1.59 in 1911 to \$3.20 in 1919, and the cost of essential crude building materials (even including sand) is from two to five times as great now as in 1913 and 1914. Five out of eight of these materials show an increase in cost over that of 1919, and only one, cement, shows a very slight decrease in cost from 1919, when it had the highest price on record.

The price of all skilled labor has increased, at a very conservative calculation, from a minimum of 56 per cent to 100 per cent, while that of common labor has increased 329 per cent and is still rising, the prices for 1920 being in all cases much higher than in 1919. Skilled labor is dissatisfied and restless and endeavoring to force wages to still higher planes, and as labor costs are 85 to 90 per cent of the cost of building materials, there is little chance of improvement in the matter until labor becomes cheaper or more efficient.

Labor shortage is due to great reduction of immigration since 1914, and the return of foreign workmen to their own countries; to the stimulation of all manufacturing industries by war conditions abroad, and very largely to the development in a wide field in this country of new industries, such as dye manufacturing and shipbuilding. The report therefore concludes: "We know of no other major influence which can bring a marked or immediate reduction in building costs, and our mature judgment is that there will be no substantial reduction for several years to come."



Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Shallow-Water Cofferdams on Soft Bottom

Wherever any kind of a structure is built in the water, unless it is supported on piles, the construction of the foundation usually requires some provision for temporarily excluding the water from the site until the work has been carried above water level. This is generally accomplished by the use of some type of cofferdam, unless the structure and conditions are of such a character that the foundation can be built in advance and placed as a whole or in sections on the base previously prepared for it, which would ordinarily be a dredged or leveled surface.

Such operations, although often possible, are not generally considered the most satisfactory and economical for small structures, and the cofferdam system in shallow water and on soft bottoms is applicable to great numbers of bridge piers, culverts, sewer outlets, river, lake and harbor work, highway and railway construction and various other ordinary jobs.

It is generally required to carry the foundation through the soft material to solid rock or a hard stratum of earth, sand, gravel or other material having the required bearing power; or to a depth sufficient to be reasonably free from danger of undermining or scour.

For very large structures, unusually exposed situations, very deep or swift water, high tides, or when affected by congested traffic or navigation or other serious difficulties, the work will require competent engineering direction, contractors experienced in this class of work, and special plant or equipment; but for ordinary cases where the depth of the water is less than 6 feet and the excavation required below the bottom is not more than 5 or 10 feet, the work can usually be executed by means of simple cofferdams easily constructed and maintained with materials, labor and equipment generally at hand.

EARTH DAMS

When the bottom is tight enough so that the water will not rise up through it to a great extent inside the cofferdam, and the current is slow and there is no danger from waves, an effective cofferdam may be made with a dam or embankment of common earth 3 or 4 feet thick on top, and with

side slopes of 3 on 1, dumped in position from wheelbarrows, trucks, cars or buckets and sometimes taken from the excavation in the cofferdam, which may suffice to build the dam. Dams are made from earth, clay, or clay and gravel mixed, but even sand and gravel will suffice for very low dams, and common earth alone will answer if the dam is thick enough.

An earth dam with a small amount of clay packed in the center from top to bottom is also efficient. If clay is hard to obtain, the amount required may be reduced by depositing it on the inner face of a bank of stone that affords stability without tightness. If any portion of the earth dam is especially exposed to waves or current, it may be protected by broken stone or gravel covering the surface. As the earth dam is likely to be at least six or seven times as wide at the bottom as on the top, considerable space must be allowed for it around the exterior of the finished structure.

If the bottom is of very coarse sand or other material that permits water to rise up through it, it may be necessary to shut off the water below the bed of the stream. This can frequently be done efficiently by driving planks or any other convenient form of sheet piling on the center line of the dam down to rock, or a hard or tight stratum which often occurs a few feet below the surface. Planks closely driven need not be absolutely water tight either above or below the bottom because the mud and sand carried through the leaks have a tendency to close the joints and the upper part of the piles will be embedded in the impervious material of the dam.

FILLED COFFERDAMS

If material suitable for an earth dam is scarce or if there is not space available for the wide base of an earth dam, two parallel lines of sheeting can be driven 3 feet or more apart and the space between them filled with rammed earth or clay. Often it is desirable to fill earth also against the outer face of the cofferdam, which will help materially to close any leak through or under the dam.

When sheet piles are used, they should be carefully aligned against outside rangers at the top, and the two lines should be separated by horizontal transverse braces and through-bolts adjacent to them tightly screwed up.

SHEET PILE COFFERDAMS

Where the bottom is very soft and loose and water flows freely through it, it may be necessary

to construct a complete sheet-pile cofferdam which is itself as nearly water tight as possible. Where the piles have to be driven to a considerable depth, or where the driving is hard on account of compact sand, gravel or obstructions like boulders, logs, etc., interlocking steel sheet piles should be used. In other cases tongue and groove or splined planks not less than 2 or 3 inches thick may suffice for moderate lengths.

Wooden sheet piles should be beveled at the lower ends so as to draw close against the pile last driven and should be driven between pairs of ranger timbers firmly held in position. To get the best results the rangers should be bolted together at frequent intervals with removable fillers and each pile as driven should be tightly wedged against the filler to maintain it closely in contact with the pile last driven and insure the proper engagement of the tongue and groove or splined joint. The rangers should be left in position and braced across the cofferdam or with inclined struts to the bottom, to resist pressure from the outside.

In very soft material the piles may be driven by hand with heavy mauls, but it is much more satisfactory and advantageous to drive them with a light drop hammer operated by power, or still better with a steam hammer actuated by steam or compressed air. A hammer improvised from a rock drill is often efficient for this purpose.

Wherever water pressure of 100 pounds or more is available, it affords the best method of driving piles in many hard, compact materials, being used as a hydraulic jet attached to the foot of the pile or sometimes operated in advance. It is especially valuable in hard sand, in fine gravel or for undermining and displacing small boulders and often enables the piles to be driven with great rapidity.

For small sheet-pile cofferdams a complete set of rangers should be set up and all of the piles assembled against them around the circumference of the cofferdam and driven simultaneously, the hammer going round and round and driving each pile a short distance and then the next and so on, in successive trips until all are driven.

If for any reason this is not practicable, there is likely to be difficulty in driving the closing pile. Sometimes this cannot be driven and the piles are driven to overlap each other or a short section of piles is driven across the gap between the first and last piles.

If subterranean obstacles like boulders or logs are encountered by the piles, too deep to be dug out, piles should be driven close to both sides of the obstacle and when the cofferdam is unwatered excavation can be carried down these to permit the removal of the obstacle and the completion of the pile driving at that point.

After the cofferdam has been completed and unwatering is commenced, if serious leaks develop through the sheet piles, they may often be stopped by dumping earth, clay or other suitable material on the exterior of the cofferdam. Sometimes excavations can be advantageously made there and then filled with the new material. Ordinary small leaks can be generally closed up by

mud, sand, earth, sawdust or manure dumped so as to be drawn into the cracks.

In very shallow water with mud bottom, cofferdams may consist of wooden panels of convenient size, wide enough for the whole height of the cofferdam walls, and as long as can be handled. Piles or cribs are located at panel lengths around the cofferdam line and these panels are set in place bearing against them and butting joints over them with their lower edges forced down as deep as possible in the bottom. These have the advantage of having tight joints except at the bearing, where they may be covered, and in good bottom may serve very well for shallow water.

For cofferdams of moderate dimensions, say up to ten or fifteen feet wide, bottomless tight wooden boxes may be built complete on shore and set in position by derricks or floated out and sunk. After being put in position they may be covered with a loading platform and quantities of stone, sand or other ballast may be placed on them to force them down as far as possible into the soft bottom, a process which may be continued after the interior excavation has been commenced.

RIVETED STEEL COFFERDAMS

Under some conditions, especially when many cofferdams of the same size can be used successively, cylindrical cofferdams made of thin steel plates riveted, may be used advantageously. These are light, absolutely water tight, easily handled, and can be used many times and salvaged after the completion of the job. They do not require interior bracing and in some cases may be arranged to provide part of the finished structure and be paid for as such. Such cofferdams can be up to 10 or 12 feet in diameter, and like the wooden panels can be made to penetrate below the surface of the ground by loading and by interior excavation, or by the use of a water jet around the edges. They should not, of course, be sunk any deeper than is necessary to secure a satisfactory seal, on account of the difficulty of removing them, which, however, may be facilitated by use of the water jet or by dredging around them if necessary.

Where a very deep excavation is required inside a small cofferdam, the use of steel cylinders may be almost inevitable in order to exclude the water and prevent the sides from caving in. It may also be necessary if the bottom is so bad so that water rises freely through it inside the cofferdam, in which case steel cofferdams can easily be dredged by buckets or scoops working under water and be driven down by loading as the excavation progresses. But if they are sunk to any great depth it will be impossible to remove them and they must be estimated as part of the construction cost.

SECTIONAL COFFERDAMS

If the cofferdam is very large or if the water enters freely through the bottom, it is usually advantageous to build it in several successive closed sections or at least to separate it by interior cross-walls, thus providing small areas which can be unwatered and excavated separately and founda-

tion units built in them piecemeal and finally joined to make the completed structure. Often a specially bad portion of quick-sand or a spring is encountered that can be handled in this way and the whole cofferdam be kept dry at one time. If particularly troublesome leaks or springs occur in the interior of a cofferdam, they can be enclosed by a small cofferdam or a steel cylinder sunk by the above-mentioned process, thus permitting the remainder of the cofferdam to be unwatered and excavated much more readily. Similarly, if very much trouble is encountered by leaks in the outer wall of the cofferdam, these portions can be enclosed by small cofferdams and either filled with puddled clay or excavated and the leaks stopped.

Sometimes when the bottom is so bad that it is impossible to prevent the water from rising through it and it becomes very difficult to unwater the cofferdam even in small sections, it is permissible to excavate to the required depth by drag-line, orange peel, clamshell or other buckets and then deposit a layer of concrete under water over the bottom. When this concrete has set it will form a seal and stop the bottom flow to a large extent. The cofferdam can be unwatered with moderate pumping and the remainder of the foundation built in the dry. In such cases it is, of course, necessary to carefully calculate the maximum upward pressure of the water under the concrete slab and make the slab thick enough and strong enough to resist it, assisted, if necessary, by ballast or bracing on top of the slab.

Concrete Arch Bridge Erected by Drop Cableway

The Springfield pike is carried across the tracks of the Big Four and of the Erie Railway near the Huffman dam in the Miami Valley by a reinforced concrete bridge by the Miami Conservancy District and described in the August number of the Conservancy Bulletin.

The bridge of the half-through, three-hinge, arch type has two ribs of 126 feet span and 21 feet rise with cast steel hinge bearings and $2\frac{3}{4}$ inch bronze pins 28 inches long. The 18-foot roadway has a girder beam, and slab floor 9 inches thick with transverse expansion joints, which is suspended from the crown of the arch and carried on columns at the ends.

The bridge was built on ordinary trestle falsework about 50 feet high with a wide center opening, spanned by heavy I-beams to provide clearance for traffic on the railroad track below.

The falsework was erected and the concrete for the structure was handled by a drop cableway of about 250 feet span located on the axis of the bridge. One end of the cableway was carried over a tower and anchored in the usual manner beyond the end of the bridge. The other end of the cableway was supported at the top of a 45-foot mast or gin-pole and thence continued to one drum of a well-anchored steam hoisting engine. The bucket was operated by a line on the other drum of the hoisting engine which

hauled it up towards the top of the mast, empty, and when full, released it and allowed it to descend by gravity. To lower the bucket, the cableway line on the engine drum was slacked off. The trolley hoist used for erecting the falsework was operated in the same way as the concrete bucket.

Concrete was mixed in a $\frac{1}{2}$ -yard Smith machine located at the end of the bridge opposite the hoisting engine and was transported to the forms in a 1-yard bottom-dump bucket.

As the concrete was placed in December and January last, special provisions were necessary to prevent injury from frost. Mixing water was heated in an extra upright boiler and sand and gravel were thawed and kept warm by fires burning in sections of old 15-inch dredge pipes over which the aggregate was piled. The top of the structure was covered with tarpaulins under which salamanders were operated until the concrete had set.

The bridge was designed and built by the Miami Conservancy District, Arthur E. Morgan, chief engineer, Chas. H. Paul, assistant engineer, R. M. Riegal, designing engineer, and Leslie Wiley, superintendent of construction.

Adjustable Wheelbarrow Gage

A satisfactory method of conveniently and quickly measuring sand and gravel, was devised for the concrete work on the Winnipeg aqueduct.

The ordinary steel wheelbarrows were fitted with a full length rectangular, transverse steel diaphragm plate with a stiffening angle and lugs that would quickly engage the sides of the barrow. Attached to it at right angles was a gage board holding it in place, that could be set so as to adjust it at any required distance from the end of the wheelbarrow and thus vary the space inclosed by it and the three sides of the barrow.

When the material was struck off with a straight edge, a definite quantity was thus accurately determined which could be used for measuring concrete and easily changed to suit varying requirements.



BARROW USED FOR MEASSURING AGGREGATE

Recent Legal Decisions

SURETY NOT RELEASED BY PAVING CONTRACT WITH TRACTION COMPANY

In the materialman's action on a bond to recover the price of brick supplied a contractor for a street improvement, it appeared that the city and a traction company made an agreement whereby the contractor should also pave the trackway. The Supreme Court of South Carolina holds, *Mack Mfg. Co. v. Massachusetts Bonding & Ins. Co.*, 103 S. E. 499, that the bonding company assented to this agreement by executing a bond to save the traction company harmless, and could not, in a suit on the street paving bond, claim that it was prejudiced by this contract with the traction company so as to release it from liability under the bond.

FAILURE TO NOTIFY OWNER OF STREET PAVING IMPROVEMENT VOIDS ASSESSMENT.

The Mississippi Supreme Court holds, *City of Jackson v. Mims*, 85 So. 124, that, under sections 3411 and 3412, Miss. Code, 1906, failure to serve the abutting property owner with notice of special improvements, such as street paving, and that the cost thereof will be assessed against the owner, renders any assessment against such owner void, and justifies the interposition of a court of equity.

PAVING CONTRACT HELD TO CONFORM SUBSTANTIALLY TO CITY'S RESOLUTION

A resolution of necessity under the Iowa Code, which requires that the resolution state "the one or more kinds of material proposed to be used and the method of construction," recited that a "cement concrete pavement seven inches in thickness, was to be laid. The city council advertised for bids for a pavement "six or seven inches in thickness," and the contract was let to the lowest bidder for a pavement six inches thick. Suit was brought to enjoin performance of the contract on the ground that the city was without authority to enter into a contract for the construction of six-inch concrete pavement instead of seven-inch pavement. The Iowa Supreme Court holds, *Richardson v. City of Denison*, 178 N. W. 532, that the resolution constituted the sole authority of the officers of the city to take bids and enter into the contract. The improvement must be the one the resolution calls for and not something different. The court said: "It is well known that the depth of concrete required for durability depends largely upon climatic condition, the kind of soil, the extent and character of the traffic, and the like, and in the absence of any showing we are not able to say that six-inch pavement will not serve the purposes of this improvement as well as though it were seven inches in thickness. If it will prove as durable and efficient in use as would a seven-inch pavement, we are inclined to the opinion that the little reduction in thickness of one inch, or one-seventh, would not be a material departure from the method of construction prescribed in the resolution. Such a resolution need not de-

scribe the material or materials of construction with technical nicety. All that is essential is that it state these in a general way, leaving the details to be wrought out in the plans and specifications." In the absence of evidence indicating that the reduction of one inch would materially affect its durability or its adaptability for the purpose proposed, it could not be said that there was a material departure by such reduction from the requirements of the resolution of necessity.

POWER TO ERECT VILLAGE HALLS WITHOUT EXPRESS STATUTORY AUTHORITY

The Minnesota Supreme Court holds, *Powers v. Village of Chisholm*, 178 N. W. 607, that a village, though without express statutory authority to do so, has power to construct a village hall for the transaction of public business. Village halls have been erected throughout Minnesota from early times without serious question of authority in the village. The village must transact public business. The power to provide a place in which it may be transacted is essential to the existence of the village. The authority to erect a village hall is incidental to the maintenance of village government.

SUFFICIENT AND INSUFFICIENT CLAIMS FOR CONSEQUENTIAL DAMAGES FOR DELAY

Where a contractor claimed consequential damages arising from delay in the work, alleged to have been the fault of the owner, a statement of claim as to the increased cost of lumber used for concrete forms was held by the Pennsylvania Supreme Court, *Cramp & Co. v. Central Realty Corp.*, 110 Atl. 763, to be sufficient, it being alleged that the amount paid was the fair and reasonable market price; but a statement of claim as to the amount paid for extra hauling, loading and unloading steel was insufficient as was an item representing the amount paid for having delivery postponed of rods to be used in concrete, there being no statement of the place from which the hauling was made, the number of laborers engaged, the time of their employment, or the wages paid them, and no other data from which it could be ascertained whether the price was in fact a reasonable one.

BOROUGH HELD NOT LIABLE FOR TOWNSHIP HIGHWAY EXPENSE

The Pennsylvania Supreme Court holds, *Plymouth Tp. v. Borough of Larksville*, 119 Atl. 801, that under the statute of June 12, 1878, providing that every borough which has been or which shall be erected out of any townships shall share in just proportion the rights and liabilities of said township or townships existing at the time of its incorporation, a borough which has been formed out of a township soon after the execution of a contract by the township to pay part of certain highway improvements, but before such payments are due, cannot be held liable for a share thereof, the debt not being an existing one.

NEWS OF THE SOCIETIES

Nov. 5-6—IOWA SECTION, AMERICAN WATERWORKS ASSOCIATION, Sixth Annual Convention, Iowa City, Iowa. Jack J. Hinman, Secretary-Treasurer State University of Iowa, Iowa City.

Nov. 8-12—LEAGUE OF CALIFORNIA MUNICIPALITIES, Annual Convention, Chico, Calif. W. J. Locke, Pacific Bldg., San Francisco, Calif.

November 12—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, Second Fall meeting, Chicago, Ill., 33 W. 39th St., New York.

Nov. 12—CONFERENCE ON EMPLOYMENT AND EDUCATION, sponsored by the American Assn. of Engineers, Chicago.

Nov. 15-17—CITY MANAGERS ASSOCIATION, Annual convention at Cincinnati, O. Executive Secretary, Harrison G. Otis, 812 Tribune Bldg., New York City.

Nov. 18-19—AMERICAN ENGINEERING COUNCIL, Organization meeting, Washington, D. C.

Dec. 7-10—AMERICAN SOCIETY OF MECHANICAL ENGINEERS, Annual meeting, New York. Secretary, 29 W. 39th St., New York City.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION, Place of meeting to be announced later.

May 17-19, 1921—NATIONAL FIREMEN'S ASSOCIATION, Twenty-third annual convention, Fort Wayne, Ind.

June 7-9, 1921—NATIONAL FIRE PROTECTION ASSOCIATION, Annual meeting, San Francisco, Cal.

June, 1921—CONFERENCE OF MAYORS AND OTHER CITY OFFICIALS, State of N. Y., 12th Annual Conference, Elmira, N. Y.

AMERICAN ASSOCIATION OF ENGINEERS

With a large attendance assured, the conference on employment and education sponsored by the American Association of Engineers, which will be held in the Congress Hotel in Chicago on November 12, promises to be an inspiring meeting. All free employment bureaus and agencies are being invited, as well as representatives from engineering societies and engineering colleges.

The purpose of the meeting is to consider the general problems of employment.

The following subjects are not all that will be considered at the conference, but are merely those which have been determined upon definitely. Additional speakers and subjects will be announced later.

George P. Hambrecht, chairman of the Industrial Commission of Wisconsin, will speak on Employment Office Administration and Technique.

A. B. Crawford, director of the bureau of appointments of Yale University, will deliver an address on Placing the Graduate in His First Position.

A. B. McDaniel, development specialist in construction for the War Department at Camp Dix, will speak on Educational Work for the Permanent Army.

Professor Arthur F. Payne, chairman of the trade and industrial department of the college of education in the University of Minnesota, has selected as his subject Vocational Analysis and the Engineer.

James P. Munroe, vice-chairman of the Federal Board for Vocational Education in Washington, will discuss

Vocational Advisement as a Prime Function of Educational Institutions.

R. O. Kramer, manager of the mechanical department of Montgomery, Ward & Co. of Chicago, will speak on Engineering Opportunities in Large Mercantile and Mail Order Houses.

A. A. Potter, dean of engineering in Purdue University, will speak on Summer Employment for Men in Teaching Service.

The session will begin at 9 a. m. and after several subjects have been discussed will divide into four group meetings at about 11 a. m. Those attending will be divided into four groups, according to present plans, (1) employers and employment manager, (2) managers or representatives of free employment bureaus, (3) representatives of educational institutions, and (4) those not in any of the other three groups.

The national Executive Committee of the American Association of Engineers has approved the proposed bill for licensing engineers, architects and surveyors in Ohio, as presented by Cecil L. Rood, president of the Ohio Engineering Society and the Ohio Association of Technical Societies, and approved by the Ohio Assembly of A. A. E.

HIGHWAY TRANSPORT CONFERENCE

At a transportation conference held September 27 and 28 at Akron, Ohio, in response to a call by the Federal Highway Council, committees were appointed to lay out and direct a movement to co-ordinate all existing transportation agencies. Highway officials from practically every section of the country were in attendance. The motor industry was well represented, and for the first time in history railways—steam and electric—waterways and express companies took part in a good roads meeting.

One of the serious phases of road development, that of sub-grade and its relation to the road surface, came before the conference, under the leadership of C. M. Upham, state highway engineer of Delaware, and vice-chairman under General Coleman DuPont, chairman of the sub-grade committee of the Federal Highway Council. The committee will seek to determine definitely how sub-soils shall be treated in order to prevent damage to the costly road surface. In the hope of accomplishing this purpose, field tests will be made to determine the bearing power of various kinds of soil, studies will be conducted in drainage, and a study will also be made to ascertain by what chemical method the bearing value of the soil may be increased. The definite and express purpose is to open the way for the construction of roads that will meet not only present, but future traffic on the highway and permit the motor truck to assume its inevitable position as a real factor in transportation.

The relation of the highways to railroads, waterways and other forms of

transportation to the end that such carrier agencies may be properly co-ordinated in public service is in charge of a committee headed by W. J. L. Banham, of New York, member of the executive committee of the National Industrial Traffic League. F. S. Holbrook, vice-president of the American Railway Express, pledged the co-operation of the interests which he represented, in the movement, to add the public highway to the nation's transportation system.

The Federal government was represented by Dr. R. S. MacElwee, director of Foreign and Domestic Commerce, Washington, D. C., and Major J. M. Ritchie, motor transport division, transportation service, Quartermaster's Corps, Washington, D. C. An educational committee under the chairmanship of W. E. Blodgett, of Philadelphia, was formed to co-operate with the Educational Bureau in furthering the efforts of the Council in practical and intelligent highway development.

Meetings of a similar character will be held at other centers where the production of highway rolling stock is a leading industry.

ENGINEERING INSTITUTE OF CANADA

A convention was held at Niagara Falls, September 16 to 18, and thorough inspection was made of the nearby Queenston-Chippawa power canal of the Ontario Hydro-Electric Power Commission and of the reconstruction of the Welland Canal by the Canadian government.

Among papers and addresses presented were an illustrated talk entitled "The St. Lawrence Route and the Welland Ship Canal," by Alexander J. Grant, engineer in charge, Welland Ship Canal. Papers by members of the staff of the Hydro-Electric Power Commission of Ontario, describing the new 500,000 h. p. hydro-electric development at the Falls were as follows: "Design of the Queenston-Chippawa Power Canal," by T. H. Hogg, assistant hydraulic engineer; "Hydraulic Installation of the Queenston-Chippawa Power Development," by M. V. Sauer, hydraulic engineer of design; "Electrical Features of the Queenston-Chippawa Power Development," by E. T. J. Brandon, electrical engineer, and a final summarizing paper by H. G. Acres, hydraulic engineer, entitled "General and Economic Features of the Queenston-Chippawa Power Development."

An interesting demonstration was given by N. R. Gibson of the Niagara Falls Power Company of his new method of measuring the flow of water in closed conduits for determining the efficiency of hydraulic turbines.

The convention was entertained at luncheons by the Department of Highways of the Province of Ontario and by the Park Commission. There was also a dinner and banquet. The convention was one of a series held in different Provinces of the Dominion and was under charge of the Niagara Peninsula branch of the Institute. It was attended by more than two hundred members and guests, including many ladies. The next one will be held in October in Halifax.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA

At the regular Pittsburgh meeting, September 21, a paper on small turbines, illustrated by lantern slides, was presented by W. J. A. London, president of the Steam Motors Company.

THE ENGINEERS' SOCIETY OF WESTERN MASSACHUSETTS

The fall meeting was held September 21, at the General Electric Company Works, Pittsfield, Mass., which were inspected with particular attention to motor construction, "Motor Application" and the principal characteristics of various kinds of motors were discussed by experts.

DETROIT ENGINEERING SOCIETY

The Detroit Engineering Society announces the following program: Nov. 5, "Conditions in Europe from a Political, Social and Engineering Standpoint," by E. J. Mehren, editor of *Engineering News-Record*; Nov. 19, "New Water Filtration Plant for Detroit," by Major T. A. Leisen, engineer for the Board of Water Commissioners.

The Alaska Road Commission has been re-organized with Major James G. Steese, Corps of Engineers, president; Captain John C. Gotwalls, Corps of Engineers, and Captain C. W. Ward, Corps of Engineers, secretary and disbursing officers. Headquarters will be at Juneau with offices also at Valdez, Seward, Fairbanks and Nome. The commission has charge of the maintenance of nearly 5,000 miles of roads and trails, which are being extended as fast as funds permit.

PERSONALS

Hart, L. H., has been appointed manager of the construction department of the National Lime Association, Washington, D. C.

Holmes, Major E., has been appointed manager of the chemistry department of the National Lime Association, Washington, D. C.

Bruce, John A., city engineer of Omaha, Neb., has resigned to return to private business.

Darcy, Henry J., has been appointed state sanitary engineer of Oklahoma.

Judd, W. A., general superintendent of the municipal water works and electric light plant of Dover, Ohio, has resigned to return to private business.

Spear, R. E., has been appointed borough engineer of Ambridge, Pa.

Bachmann, Frank, formerly chief chemist, Connecticut State Department of Health, has resigned to join the staff of the Sanitary Engineering Department of the Dorr Company.

Holmgreen, E. L., has been appointed to the engineering staff of the Manitoba Power Commission, Winnipeg.

Allan, E. B., has been appointed assistant road engineer, Hamilton, Ont.

Longino, J. L., has been made manager of the Pine Bluff Co., Pine Bluff, Ark., operators of street railway, electric light and water properties.

Mitchell, McClain, superintendent of public improvements of Paducah, Ky., has been appointed city engineer.

Arnold, Ralph R., county engineer of Contra Costa county, California, has been appointed county highway engineer.

Watkins, Vaughn, has been appointed state highway commissioner of Mississippi.

Bennett, M. O., formerly engineer of the Oregon State Highway Department, will start farming on a large scale in Lewistown, Mont.

Hepburn, Donald M., has resigned as chief of construction of the Pennsylvania State Highway Department.

Sauerbun, Alfred H., has been named to succeed Mr. Hepburn.

Sacket, W. H., formerly with the engineering staff of the Wisconsin State Highway Commission, is now connected with the Forest Products Laboratory.

Couzens, Henry Herbert, chief engineer of the Toronto Hydro-Electric System, has been granted an indefinite leave of absence, during which time he will act as manager of the new Transportation Commission of the city of Toronto. When the commission is fully organized he will resume his duties as chief engineer, directing the work of the commission also.

Ashworth, Edw. M., has been appointed general manager of the Toronto Hydro-Electric System during the leave of absence of Mr. Couzens.

Gillespie, Peter, for the past nine years associate professor in the Department of Applied Mechanics, Faculty of Applied Science and Engineering, University of Toronto, has been given the rank of professor.

Snaith, Wm., formerly principal assistant engineer with Frank Barber and R. O. Wynne-Roberts, has resigned to accept an appointment as chief draftsman of the Riordon Co., Ltd., Mattawa, Ont.

Blanchard, Arthur H., Professor of Highway Engineering and Highway Transportation at the University of Michigan, has been appointed Consulting Engineer to the Michigan State Highway Department.

Bruce & Grupe, engineers, 312 Karbach Bldg., have changed their address to Room 404, Finance Bldg., Omaha, Neb.

Coulson, R. H., has been appointed district engineer of the western district, New York Central Lines.

Crissey, Jackson R., formerly city engineer of Johnstown, Pa., will enter the construction field.

Druar & Milinowski, recently organized, will have their offices at 512-14 Globe Bldg., St. Paul, Minn. They will continue with the work of Mr. Druar, consisting mainly of municipal engineering and hydro-electric developments.

Henderson, Charles E., manager of the Windsor, Ont., branch of Morris Knowles, Ltd., has been appointed division engineer of their Detroit office.

Keith, J. Clark, of Morris Knowles, Ltd., Windsor, Ont., has been appointed assistant chief engineer of the Essex Border Utilities Commission, having jurisdiction over the water supply, sewerage and park systems of the seven municipalities bordering on the Detroit river.

Norcross, T. W., has been appointed

chief engineer of the Forest Service, U. S. Department of Agriculture

Patzig, Monroe L., consulting engineer, Des Moines, has been appointed plant inspector for asphaltic paving materials now being used in Rock Island, Ill.

Routh, James W., director and chief engineer of the Rochester Bureau of Municipal Research, has opened offices at 501 Arlington Bldg., Rochester, N. Y., where he will be available as a consulting municipal engineer.

Shaughnessy, C. S., formerly engineering examiner in the New York City Civil Service Commission, has been appointed chief examiner of the Civil Service Commission of Philadelphia.

Shaw, Arthur M., consulting engineer, New Orleans, La., will have general direction of the civil engineering department of Loyola University, retaining his office for private practice.

Stephenson, E. J., of Minneapolis, has been appointed civil engineer for the United Light & Railway Co., Davenport, Ia.

Washington, W. O., formerly engineer of Caldwell County, Tex., has been appointed highway engineer for Cameron county, with headquarters at Brownsville, Tex.

Raines, Hugh B., died in Louisville, Ky., September 17. Mr. Raines was for twenty years city engineer of Dallas, Texas, retiring several years ago.

Bussler, William C., chief engineer of water works, Waterloo, Iowa, died in that city on September 12.

Dietrich, William Henry, resident engineer of the U. S. Steel Products Co., in Bombay, India, died in that city August 11.

Cooley, George W., state engineer and secretary of the Minnesota Highway Commission, died in Minneapolis, September 25.

Isaacs, John J., Jr., chief engineer, S. J. Junkins & Co., Ltd., was accidentally killed October 1.

Sherman, James H., president Sherman Engineering Co., Kansas City, Mo., died on October 2.

JAMES W. ROUTH, C.E.

James W. Routh, C. E., Director and Chief Engineer, Rochester Bureau of Municipal Research, Inc., announces that he is available for service as consulting municipal engineer and is prepared to conduct investigations, prepare plans, specifications and reports, and supervise operations in connection with all municipal engineering activities.

Special service can be rendered municipalities interested in improving the organizations and administrative procedure of their departments of government. Offices, 501 Arlington Bldg., Rochester, N. Y.

STEVENS & KOON

J. C. Stevens and R. E. Koon announce their new consolidation under the firm name Stevens & Koon, consulting engineers. Particular attention will be given to matters pertaining to municipal improvements, water supply, sewerage, irrigation, hydro-electric power, appraisals and valuation. Offices, Spalding Bldg., Portland, Ore.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

LIDGERWOOD STEAM HOISTS

Steam hoisting engines for contractors' uses are described in Bulletin 2, issued by the Lidgerwood Manufacturing Company. A large variety of standard machines include types designed for bridge and building erection, building elevators, derricks, pile-drivers, dredges, drag buckets, inclines, quarries, prospectors' use, shafts, etc., together with a considerable amount of auxiliary equipment, such as boilers, boom swinging engines, drum frictions, swinging drums and swinging gears. Of each type there are given the principal data, including the weight hoisted on a single rope at given speed for the rated horse-power, together with the principal dimensions.

All of the standard hoists are built on the duplicate part system, which makes the parts interchangeable and allows the manufacturers to keep in stock a full line of finished parts to fill repair orders instantly. All engines are set up and run under steam before shipping.

The drums are accurately balanced to prevent undue wear of the bearings and the brakes are usually of the band type lined with hard-wood blocks and provided with adjustment for taking up wear.

In ordering hoists, the purchasers should state the maximum load, speed and height, whether the load is to be hoisted on a single line or with a tackle, the diameter of rope used, the frequency of hoisting, and, if light loads are to be hoisted and heavy loads lowered, specify the load to be lowered, how far and at what speed.

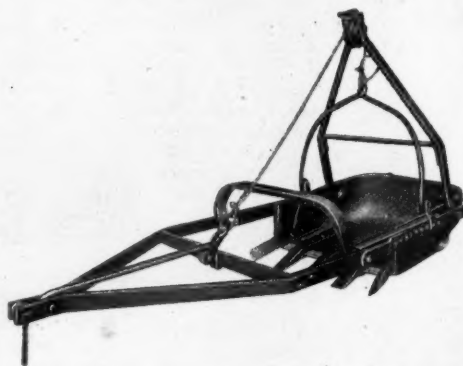
ECONOMY EXCAVATOR

The "Economy Excavator" is primarily intended for jobs involving from 10,000 to 20,000 yards of open ditch work as well as for cleaning bottoms of large open ditches. It is also largely used for constructing large tile drains and sewers. The low operating cost and upkeep and large capacity recommend it for a large amount of work in ditches, trenches, banks, road construction, wagon and car loading, irrigation work and the like for which it has attained a high degree of efficiency.

In open work the long boom enables it to dig a much wider ditch than can be done with the average small excavator, and it will dig to any required slope and leave the sides smooth. In such work the machines excavate as much as 125 cubic yards per hour and often 500 yards per shift.

The machine can be erected by four men in an average time of three days and is operated by only two men, one to handle the levers and one to do general work around the machine.

A special type of machine with booms long enough for any ditch up to 40 feet wide, is recommended for ditch cleaning and repairing, and for the enlarge-



BUCKET IN EXCAVATING POSITION

ment of irrigation ditches. For laying lines of large tiles, four men are sufficient. Tiles up to 42 inches in diameter can be handled with the standard bucket and up to 28 inches with a narrower trench digging dipper.

In back-filling the bucket is never hoisted and often moves 1 to 1½ yards of material at each operation, five to seven of which can be made per minute.

One contractor writes that he has loaded 500 yards of material into wagons in one shift.

The machine is equipped with a 40-horse-power gasoline and kerosene engine. It has a very heavy, durable steel frame and the wheels have tires 36 inches wide. The trussed boom is in two parts. The 5-yard capacity digging dipper will work equally well in dry material or under water, and when the fill line is slacked it dumps immediately. All the working parts are driven with friction clutches, which are of the same size, so that the blocks and fingers are interchangeable.

MANHOLE COVERS

The D. & D. Safety and Noiseless Manhole or Catch Basin Cover is apparently meeting a real want. The city of Minneapolis used six in 1916 as an experiment. The next year twelve were bought, in 1918 fifty, in 1919 601 and in 1920 that city will use about 600. The covers seem to be giving satisfaction wherever used. The city engineers of Cincinnati and Oak Park, Ill., where the covers are in use, say that they do not rattle or become loose.

It is claimed that these covers can be sold at about the cost of the ordinary covers and that they have a longer life. The Wm. E. Dee Company is the manufacturer.

NEW TRUCK CATALOG

The Parker Motor Truck Company announces that its new catalog is ready for distribution. It is unique in that it is confined almost exclusively to truck features, all sales talk having been omitted. Recent changes in models are incorporated.

THE LA FRANCE FIRE ENGINE CO., INC.

During the month of September there were reported from this company 24 sales of fire-engines and trucks, ten of which were repeat orders. The shipment for the same period totaled 44 engines, cars and trucks, besides 3 Brockways which were distributed throughout 22 different states.

INDUSTRIAL NOTES

NATIONAL LIME ASSOCIATION

Further extensions of the organization of the National Lime Association for educational publicity work have recently been made. This is in the direction of intensifying the local or district work. The latest extension of the organization consists of the establishment of a central bureau in the Mississippi Valley, comprising Districts 7 and 12 of the association which include the states of Indiana, Illinois, Missouri, Nebraska, Colorado, Kansas, Oklahoma, Arkansas and Louisiana. The officers of this central bureau are Col. C. W. S. Cobb of the Glencoe Lime & Cement Co. of St. Louis chairman, and T. P. Black of the Black White Lime Co. of Quincy, Ill., secretary. They will employ a permanent field man, who is a trained engineer along construction lines and qualified to deal with the chemical and agricultural uses of lime, to traverse the territory and assist in the best use of lime products in the three aspects in which it is employed, namely, in construction, in various chemical industries, and in agriculture.

Committee C-7 of the American Society for Testing Materials, which has in its charge all matters relating to lime, met on October 4 and 5 in the rooms of the Society in Philadelphia. The committee comprised representatives of the leading manufacturers of lime, engineering schools of well-known universities, American Institute of Architects, State Highway Departments, engineering firms, the Bureau of Standards, the Bureau of Soils, Department of Agriculture, Geological Survey, the Plasterers' Union, Agricultural Experiment Stations and manufacturers who use lime reactions in their processes. The personnel of the general committee appears on the attached sheet.

Important developments along the lines of plasticity, chemical analysis, effects on concrete and specifications for various uses, secured a large attendance.